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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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ED 059300

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

BOMB-FUSE PARTS ASSEMBLER (Ammunition) 6-54.052
B-235 or S-24

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EDUCATION & WELFARE
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GATB #660
November 1951

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR BOMB-FUSE PARTS ASSEMBLER (Ammunition) 6-54.052

Summary

The General Aptitude Test Battery, except Part E, was administered to 90 Bomb-Fuse Parts Assemblers (ammunition) 6-54.052 hired and employed by the National Pressure Cooker Company of Eau Claire, Wisconsin, for the purpose of developing norms for this occupation. The criterion used in developing the norms consists of a rank rating given by the foreman in charge of each group of workers for each worker under his supervision. The following aptitudes were found to be significant for this occupation: Form Perception (P), Aiming (A), Finger Dexterity (F) and Manual Dexterity (M).

Norms for Bomb-Fuse Parts Assembler (Ammunition) 6-54.052.

The norms for the occupation of Bomb-Fuse Parts Assembler (ammunition) 6-54.052, include those parts of the General Aptitude Test Battery measuring Aptitudes P, A, F, and M. Applicants must meet the critical aptitude score on each aptitude to be referred as test selected for this occupation.

Table I shows the minimum acceptable score for each aptitude included in the norms.

TABLE I
Minimum Acceptable Aptitude Scores for B-235 or S-24

Aptitude	Tests	Minimum Acceptable Aptitude Scores
P	CB-1-A CB-1-L	95
A	CB-1-C CB-1-K	85
F	CB-1-O CB-1-P	85
M	CB-1-M CB-1-N	85

Effectiveness of Norms,

The efficiency of the test norms is shown in Table V. It shows that 14 of the 20 poorer workers, or 70 percent, failed to achieve the minimum scores established as cutting scores for these norms. Of the 63 workers who made qualifying test scores 57, or 90 percent, proved to be good workers. This indicates that if the test norms had been used for selection, 70 percent of the poorer workers would not have been hired and that 90 percent of those hired would have been good workers.

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Technical Report

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Bomb-Fuse Parts Assembler (ammunition) 6-54.052.

II. Sample

The original sample consisted of 148 female applicants for the job of Bomb-Fuse Parts Assembler (ammunition) 6-54.052 at the National Pressure Cooker Company of Eau Claire, Wisconsin. All of the 148 applicants were given the GATB but hiring was done without regard to test scores. Of the 148 applicants tested, 58 were not included in the final sample either because they were not hired or because they failed to work long enough to be rated by their foremen. This resulted in a final sample of 90.

Single women between the ages of 18 to 40 were preferred. They were selected on the basis of a personal interview and reference checking.

Table II shows the means, standard deviations, ranges, product-moment correlations with the criterion corrected for broad categories, and standard errors of correlation for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Range, Correlations with Criterion Corrected for Broad Categories ($_{c}r$) and Standard Errors of Correlation ($\sigma_{_{c}r}$) for Age, Education, and Experience

Bomb-Fuse Parts Assembler (Ammunition) 6-54.052
N=90

	M	σ	Range	$_{c}r$	$\sigma_{_{c}r}$
Age (yrs.)	21.6	4.2	18-39	-.129	.104
Education (yrs.)	11.2	1.5	7-15	.193	.101
Experience (weeks)	6.5	2.2	3-13	.184	.102

For this sample, the relationships of age, education and experience with the criterion are not significant. The range for experience is restricted because all examinees were new employees. However, three weeks were considered to be sufficient time for a valid evaluation to be made of a worker's job performance.

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III. Job Description

Job Title: Bomb-Fuse Parts Assembler (Ammunition) 6-54.052

Job Summary

Performs subassembly and final assembly operations on machined bomb-fuse parts, using hand and power tools. Visually examines machined parts for bomb-fuse assemblies. Removes burrs, sharp edges, and excess metal by using files, picks, and various power machines. Performs subassembly or final assembly of finished parts by drilling holes, inserting and fastening pins and springs, and using hand tools such as screw driver and tweezers, and power tools such as riveting machines, capping chucks, spinning machines, kick presses and drill presses. Applies rust-proof lacquer to certain parts, packs assemblies in cardboard containers.

Work Performed

Examines visually a variety of brass, steel, aluminum, and cadmium plated machined parts before assembly for burrs, sharp edges, and excess metal which remains as a result of machining, using magnifying glass on smaller parts; removes burrs, sharp edges, shoulders, and excess metal with hand reamers, files and picks or with various power drill and arbor presses, reamers, and grinders; inspects a variety of finished and plated parts for accuracy of tolerances, size of parts, proper machining, airtightness, and color and texture of plating using magnifying glass, special gauges, dies, and fixtures and rejects defective parts or sets aside for salvage; performs subassembly or final assembly of finished parts including drilling of holes, capping of parts, inserting and fastening of pins and springs using hand tools such as screw drivers and tweezers and power tools such as riveting machines, capping chucks, spinning machines, kick presses and drill presses; applies rust proof lacquer to certain parts, packs assemblies in cardboard containers. May perform any one or more of above tasks.

IV. Experimental Battery

All of the tests of the GATB, with the exception of Part E, were administered to the sample group.

V. Criterion

The criterion used consisted of the foremen's ratings of the 90 workers who remained in the final sample. Eight foremen rated the 90 workers. Four foremen used the rank comparison method to rate the workers under their supervision. The remaining four foremen rated the workers under their supervision by placing them into three categories: above average, average, and below average. These eight groups ranged in size from three workers in the smallest group to 29 workers in the largest group.

The eight groups were combined, and then divided into three categories, A, B, and C. Each category has 20, 50, and 20 workers respectively. This was possible because of the comparability of the rating methods used by each of the eight foremen. Approximately equal proportions of each of the

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four rank comparison groups were put into categories A, B, and C. In the other four groups, workers rated as above average, average, and below average were placed in groups A, B, and C respectively. The criterion was converted to quantitative values which resulted in criterion scores of 63 for group A, 50 for group B, and 37 for group C.

V. Statistical and Qualitative Analysis

The aptitudes significant for job performance were determined on the basis of mean scores, job analysis data, and correlation between aptitude scores and the criterion.

Table III shows the means, standard deviations, product-moment correlations with the criterion corrected for broad categories and standard errors of correlation for each aptitude of the GATB.

TABLE III

Means (M), Standard Deviations (σ), Product-Moment Correlations with the Criterion Corrected for Broad Categories ($_{c}r$) and Standard Errors of the Correlations (σ_{cr}) for each Aptitude of the GATB

Bomb-Fuse Parts Assembler (Ammunition) 6-54.052
N=90

Aptitude	M	σ	$_{c}r$	σ_{cr}
G	99.9	12.8	.206	.101
V	94.3	10.4	.345	.093
N	100.6	15.8	.250	.099
S	102.4	15.3	.117	.104
P	108.7	13.8	.326	.094
Q	100.3	13.9	.226	.100
A	99.7	14.4	.257	.098
T	95.5	17.7	.133	.104
F	101.6	18.7	.367	.091
M	101.8	15.8	.310	.096

Table IV shows the means, standard deviations, standardized means and standardized standard deviations, product-moment correlations with the criterion corrected for broad categories, and standard errors of correlation for each test of the GATB.

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TABLE IV

Means (M), Standard Deviations (σ), Standardized Means (M') and Standardized Standard Deviations (σ'), Product-Moment Correlations with the Criterion Corrected for Broad Categories (cr) and Standard Errors of Correlation (σ_{cr}) for each Test of the General Aptitude Test Battery

Bomb-Fuse Parts Assembler (Ammunition) 6-54.052
N=90

Test	M	σ	M'	σ'	c^r	σ_{c^r}
A	23.8	4.2	110	15	.259	.098
B	71.3	13.9	101	14	.226	.100
C	44.3	5.2	101	15	.335	.094
D	26.5	6.3	100	17	.164	.103
F	22.4	6.6	100	17	.262	.098
G	128.4	19.1	94	19	.133	.104
H	18.5	5.3	103	16	.080	.105
I	9.1	2.7	103	16	.115	.104
J	18.3	4.8	95	11	.344	.093
K	70.5	8.1	99	17	.071	.105
L	28.1	6.3	105	17	.379	.090
M	88.8	6.6	102	16	.324	.094
N	101.7	8.0	102	19	.146	.103
O	27.8	4.4	101	19	.357	.092
P	29.4	3.4	103	19	.263	.098

On the basis of the job analysis the following aptitudes measured by the GATB are required to a significant degree:

1. Form Perception (P) - required in examining parts for burrs, sharp edges and excess material.

2. Aiming (A) - required in the ability to place parts to be gauged, burred, capped, and drilled; in drilling holes; in inserting and fastening pins; and in using tweezers and other hand tools.

3. Finger Dexterity (F) - required in use of fingers in assembling parts by inserting and placing the various pieces and in using small hand tools.

4. Manual Dexterity (M) - required in handling the parts and in turning the parts over.

Considering the mean scores, as shown in Table III, Aptitudes P, S, M, and F were found to have the highest means. It should also be noted from Table III that the standard deviations are well below the general population standard deviation of 20, which indicates that this sample is a relatively homogeneous group with respect to these aptitudes measured by the GATB.

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In Table III Aptitudes V, P, F, and M show significant correlation at the 1% level. Aptitudes N, Q, and A show significanct correlation at the 5% level. On the basis of a relatively high mean (108.7), an r of .326 and significance indicated in the job analysis, Aptitude P was selected for inclusion in the test norms. The mean of 101.8, an r of .301 and its significance indicated in the job analysis led to the choice of Aptitude M for inclusion in the norms. Aiming (A) was included in the test norms because of its r of .257 and its importance as indicated in the job analysis. Finger Dexterity was included because of its mean of 101.6, its r of .367, and its significance as indicated by the job analysis. Although aptitude S has a relatively high mean (102.4), and aptitudes V, N, and Q show significant correlation with the criterion, it was not considered advisable to include them in the final norms because they were not considered significant on the basis of job analysis data.

Based on the above considerations, norms were set up consisting of Aptitudes P, A, F, and M with critical scores set at approximately one standard deviation below the mean of the sample for each aptitude. This resulted in critical scores for each aptitude as follows: P=95, A=85, F=85, and M=85.

Table V shows the relationship between the criterion and the selected norms P, A, F, and M. The criterion was dichotomized by placing the 70 workers in groups A and B in the high criterion group and the 20 workers in group C in the low criterion group. The high criterion group has been designated as "good workers" and the low criterion group as "poor workers."

TABLE V

Relationship between Test Norms Consisting of Aptitudes P, A, F, and M with Critical Scores of 95, 85, 85, and 85 Respectively and the Criterion for Bomb-Fuse Parts Assembler (Ammunition)

N=90

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	13	57	70
Poor Workers	14	6	20
Total	27	63	90

r_{tet}=.73

$\sigma_{r_{tet}}$=.19

$X^2 = 17.219$

$\frac{p}{2} < .0005$.

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The data in Table V yielded a tetrachoric correlation of .73 with a standard error of .19. Chi square was computed to be 17.219 which results in a $\frac{P}{2}$ value of less than .0005. This indicates a significant relationship between the selected test norms and the criterion.

Since Occupational Aptitude Pattern 17 (P=85, A=100, F=100) includes aptitudes and minimum scores similar to those in the norms P, A, F, and M with critical scores of 95, 85, 85, and 85 respectively, a tetrachoric correlation was computed for OAP 17 and the criterion. The tetrachoric correlation obtained was .37 with a standard error of .19. Chi square was computed to be 1.913 and $\frac{P}{2}$ was less than .10. Although a low positive relationship was obtained between OAP 17 and the criterion, it is not a significant relationship.

VII. Conclusion

On the basis of the job analysis, mean scores, and correlations with the criterion, it is recommended that Aptitudes P, A, F, and M with critical scores of 95, 85, 85, and 85 respectively be used as norms for Bomb-Fuse Parts Assembler (ammunition) 6-54.052.